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A downward head posture leads to higher cervical spine loading during head-first impacts in simulated rugby tackles.

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Background: A rugby tackle is an open and unpredictable event, which can lead to intentional or unintentional head-first impacts rather than the preferred 'shoulder first' technique.

Objective: To identify the effect of head-neck orientation as well as collision speed on the loads experienced at the upper cervical spine and the relevance in terms of injury risk from head-first impacts.

Design: Repeated 'tackles' were simulated using a 40 kg punch bag (simulated ball carrier) making contact against a fixed instrumented head and neck anthropometric test device (ATD).

Setting: Biomechanics laboratory.

Patients (or Participants): A single head-neck ATD was used to complete all the trials.

Interventions (or Assessment of Risk Factors): 10 repetitions were recorded in each of two speed ranges (low and high) and 3 ATD sagittal plane orientations (head-up [+20°], neutral [0°], and head-down [-20°]), 60 trials in total.

Main Outcome Measurements: Forces experienced at the equivalent of the C1 vertebra were measured by a load cell at the head joint of the ATD. ANCOVA (covariate=punch bag speed) and effect sizes were used to assess differences between tackle conditions.

Results: Low speed (2.34 ± 0.18 m/s) tackles resulted in 37% lower peak impact forces compared with high speed (3.43 ± 0.17 m/s) tackles. Total force on neck acted in multiple directions (75% in compression; magnitude of total force was 2.37 ± 0.18 kN in neutral high speed condition) and it was substantially higher in the head-down orientation compared with the neutral (13%) and head-up orientation (17%).

Conclusions: Our findings support the idea that: 1) collision speed during a tackle affects the load experienced by the head-neck structures; 2) a neutral or head-up orientation of the head is preferred to a head-down orientation in the event of head-first impacts during simulated rugby tackle, which aligns with current Rugby Union coaching recommendations.